Quarterly Report – Public Page

Date of Report: November 26, 2008

Contract Number: DTPH56-08-T-000009

Prepared for: DOT

Project Title: "MWM-Array Detection & Characterization of Damage through Coatings and Insulation"

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Public Page Section-

This project is aimed at developing improved nondestructive evaluation (NDE) methods for detection and characterization of damage in pipelines, from the outside, through coatings and insulation. The damage conditions of interest include internal and external corrosion, mechanical damage, and stress corrosion cracking (SCC). This will be accomplished by adapting JENTEK Sensors Inc.'s proven MWM-Array technology and developing a field deployable MWM-Array tool. The magnetic field-based sensor arrays and JENTEK model-based inverse methods are used to determine electromagnetic and geometric properties of the pipeline material, which are then related to specific damage conditions of interest. This technology has been successfully applied in the aerospace and manufacturing industries and provides substantially improved performance for imaging surface and buried damage through coatings and for curved surfaces compared to conventional NDE methods.

During the second period of this program, we have fabricated and acquired additional samples for testing purposes, performed simulations of MWM-Array to determine improvements needed for inspection through moderate to thick coatings, investigated alternative sense elements, and started enhancing procedures for inspection of external metal loss through coatings. The point of contact for this program is Andrew Washabaugh (jentek@shore.net, 781-642-9666).

General Information required on all Public Quarterly Reports

Results and Conclusions:

This section summarizes progress made in the combined program. This contract is aimed at developing instrumentation for characterizing damage in pipelines, including external corrosion, internal corrosion, stress corrosion cracking (SCC), and mechanical damage, with one set of tasks (No. 304) for inspection from outside the pipeline and another (No. 306) for inspection from inside the pipeline. This contract is complemented by funding from Chevron.

Progress has been made in a number of areas:

- Samples with Representative Damage Conditions: One aspect of this program has been on the identification of available samples or fabrication of samples having representative damage conditions for use in development of the measurement techniques. Pipeline samples for both usage-related damage and simulated damage conditions are being made available. Flat plate samples were fabricated and cylindrical pipe sections have been acquired for demonstration purposes and procedure development.
- Large format sensor simulation and fabrication – Numerous simulations were performed in order to understand how the sensor design can be modified to improve measurement responses through thick coatings. A sensor was fabricated and initial testing was performed.
- External inspection scanner: A scanning fixture to accommodate the large format sensor was designed.
- Demonstration Measurements: Additional demonstration measurements for simulated material loss through thin to moderate thickness coatings were performed using several JENTEK sensor arrays and a flat steel plate. These relatively high frequency measurements demonstrated how JENTEK's measurement grids and multivariate inverse methods can be used to rapidly provide images of areas with material loss.
- Alternative sense elements: Several different devices were reviewed to determine benefits and disadvantages in use as low frequency elements in imaging sensor arrays. Low frequency measurements are required for the inspecting magnetic field to be able to penetrate through the pipeline thickness.

Plans for Future Activity:

1. Continue to acquire or fabricate specimens having representative damage conditions.
2. Adapt procedures and perform demonstrations for through-coating measurements.
3. Continue testing of prototype sensor for damage imaging and fabricate new sensors as appropriate.
4. Adapt instrumentation to support low frequency measurements.